

TONOPORT V

Service Manual

Firmware Versions FW1.4 and FW2.0
Hardware Versions HW1.2 and HW2.0

2001589-023

Revision H



GE Medical Systems
Information Technologies

gemedicalsystems.com

NOTE: The information in this manual only applies to the product TONOPORT V, Firmware Versions FW1.4 and FW2.0 and Hardware Versions HW1.2 and HW2.0. Due to continuing product innovation, specifications in this manual are subject to change without notice.

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1 Introduction

1.1 Manual Information

1.1.1 Revision History

Each page of the document has the document part number and revision letter at the bottom of the page. The revision letter identifies the document's update level.

The revision history of this document is summarized in the table below.

Table 1. Revision History PN 2001589-023		
Revision	Date	Comment
A	2000-03	Initial release
B	2001-01	ECO 066338, update due to release of FW1.1
C	2001-04	ECO 066834
D	2001-06	ECO 067061, FW1.2
E	2001-10	ECO 068207, FW1.3
F	2002-07	ECO 071404, FW1.4, HW1.2
G	2003-12	ECO 075536
H	2006-05	ECO 080491, FW2.0/HW2.0

1.1.2 Manual Purpose

This manual supplies technical information for service representative and technical personnel so they can maintain the equipment to the assembly level. Use it as a guide for maintenance and electrical repairs considered field repairable. Where necessary the manual identifies additional sources of relevant information and or technical assistance.

See the operator manual for the instructions necessary to operate the equipment safely in accordance with its function and intended use.

1.1.3 Intended Audience

This manual is intended for the person who uses, maintains, or troubleshoots this equipment.

1.2 Safety Information

1.2.1 Responsibility

GE Medical Systems *Information Technologies* is responsible for the effects of safety, reliability, and performance only if:

- Assembly operations, extensions, readjustments, modifications, or repairs are carried out by persons authorized by GE Medical Systems *Information Technologies*.
- The electrical installation of the relevant room complies with the requirements of the appropriate regulations.
- The equipment is used in accordance with the instructions for use.
- The country of manufacture appears on the device label.

1.2.2 General

This device is not intended for home use.

Contact GE Medical Systems *Information Technologies* for information before connecting any devices to the equipment that are not recommended in this manual.

Parts and accessories used must meet the requirements of the applicable IEC 60601 series safety standards, and/or the system configuration must meet the requirements of the IEC 60601-1-1 medical electrical systems standard.

Periodically, and whenever the integrity of the device is in doubt, test all functions.

The use of ACCESSORY equipment not complying with the equivalent safety requirements of this equipment may lead to a reduced level of safety of the resulting system. Consideration relating to the choice shall include:

- use of the accessory in the PATIENT VICINITY; and
- evidence that the safety certification of the ACCESSORY has been performed in accordance to the appropriate IEC 60601-1 and/or IEC 60601-1-1 harmonized national standard.

If the installation of the equipment, in the USA, will use 240V rather than 120V, the source must be a center-tapped, 240V, single-phase circuit.

The authorized representative for GE Medical Systems Information Technologies Inc. in Europe is :

GE Medical Systems Information Technologies GmbH
Munzinger Strasse 3
D-79111 Freiburg
Germany
Phone +49-761 4543 0
Fax +49-761 4543 233

1.3 Service Information

1.3.1 Service Requirements

Follow the service requirements listed below.

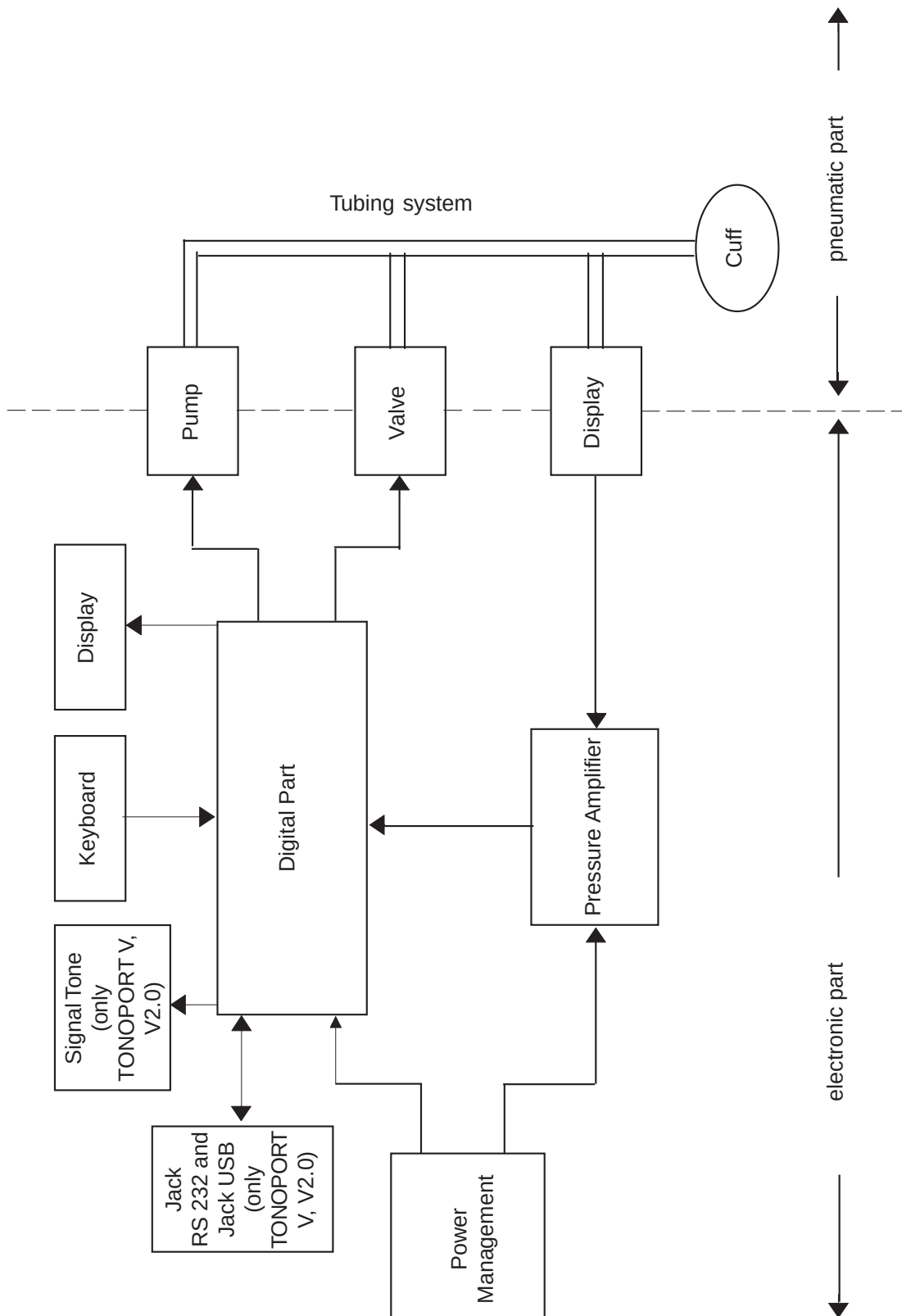
- Refer equipment servicing to GE Medical Systems *Information Technologies*' authorized service personnel only.
- Any unauthorized attempt to repair equipment under warranty voids that warranty.
- It is the user's responsibility to report the need for service to GE Medical Systems *Information Technologies* or to one of their authorized agents.
- Failure on the part of the responsible individual, hospital, or institution using this equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards.
- Regular maintenance, irrespective of usage, is essential to ensure that the equipment will always be functional when required.

CAUTION

During repairs/service interventions, observe the protective measures against damage due to ESD.

For your notes

2 Block Diagram



For your notes

3 Functional Description

Button / Switch	Display	Button	Display	Explanation
ON	all segments			selftest
	A100			A=accu (rechargeable battery) 100=100%
	clock			
Info	H 1	Start/Start	LLLL	delete record
Info	H 2	Start	YYYY MM DD hour min	date time
Info	H 3	Start/Start Info	LLLL P1 P2 P3	internal programs
Info	H 4	Start	50	pressure offset
		Start	0	calibration mode (manometer)
Info	H 5	Start	20:01	20:= FW2.0 01=German 02=English 03=French 04=Italian 05=Spanish
Info	H 6	Start	AAAA	accu
		Info	bbbb	battery
Info	H 7	Start	1111	signal tone ON (TONOPORT V, V2.0 only)
		Info	0000	signal tone OFF (TONOPORT V, V2.0 only)

Measurement limits

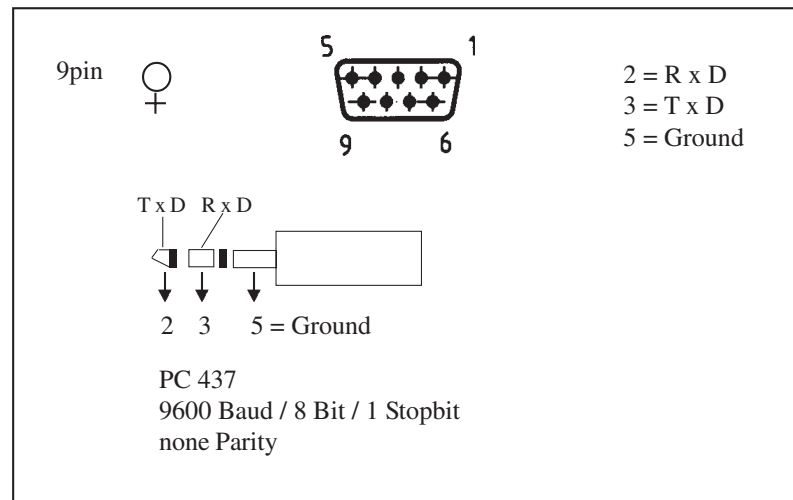
- Max. cuff inflation time = 100 seconds
- Max. measurement time after start of measurement = 180 seconds

For your notes

4 Pin Connections

See diagram

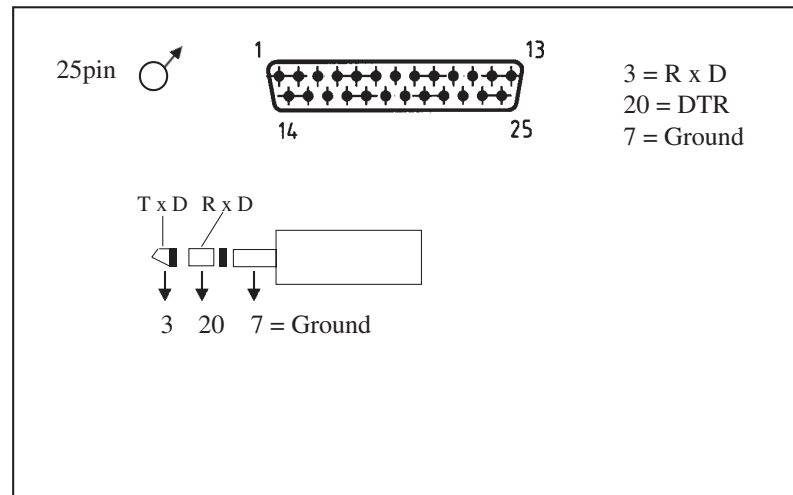
Cable RS 232 TONOPORT V - PC 2001589-011



Cable USB TONOPORT V - PC (2001589-040) - not shown

This cable connects the USB port of TONOPORT V, V2.0 (USB B-mini, male, 5-pin) to the USB port (USB A, male) of the PC.

Cable TONOPORT V - Printer 2001589-012



For your notes

5 Instrument Versions

The instrument is available in one version only. Five different languages, however, are available for the direct printout. These languages are:

Old version

2001589-001	TONOPORT V
-------------	------------

New version

2001589-038	TONOPORT V, V2.0
-------------	------------------

- **Displaying the firmware version and the language for the direct printout**
 - ◆ Switch TONOPORT V on and wait until the **time** appears on the screen
 - ◆ Press **INFO** five times: Display shows "H 5".
 - ◆ Press **START**: the firmware version and the language for the direct printout are now displayed.

From firmware FW1.3 the language can be changed by pressing **INFO** until the required language code is displayed. Pressing **START** terminates the language selection.

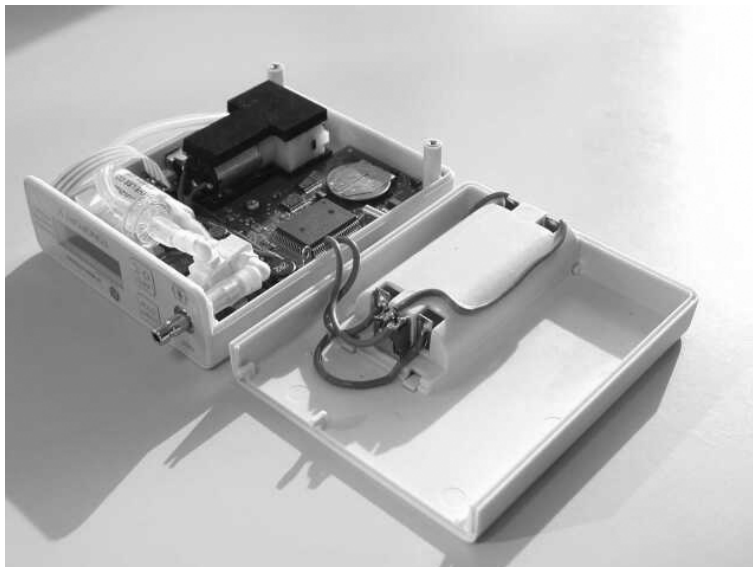
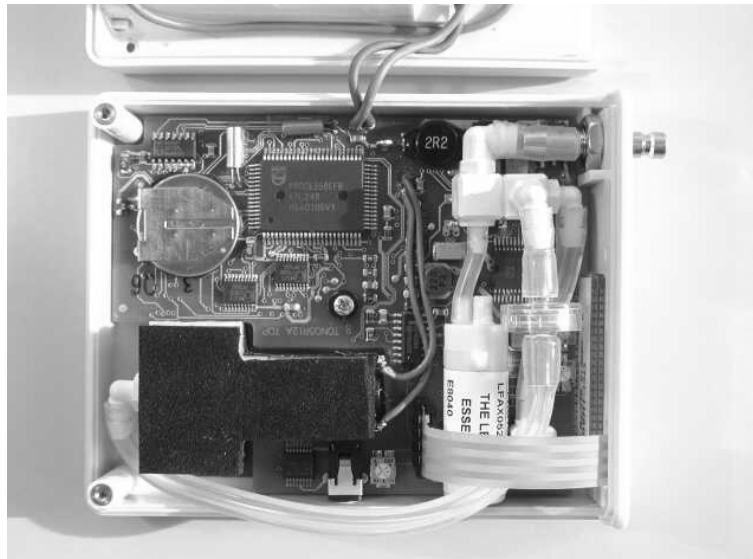
Firmware Version : Language Code	Language
10 : 01	German
10 : 02	English
10 : 03	French
10 : 04	Italian
10 : 05	Spanish
Firmware Version : Language Code	Language
11 : 01	German
11 : 02	English
11 : 03	French

Instrument Versions:

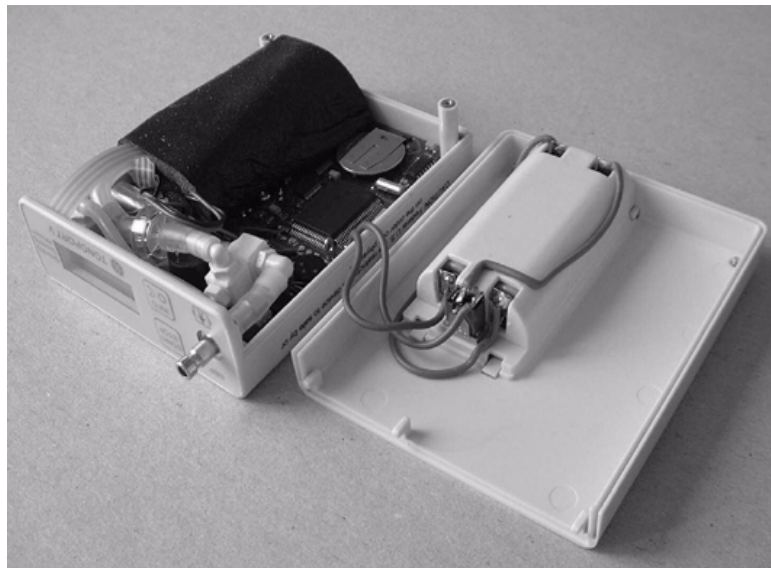
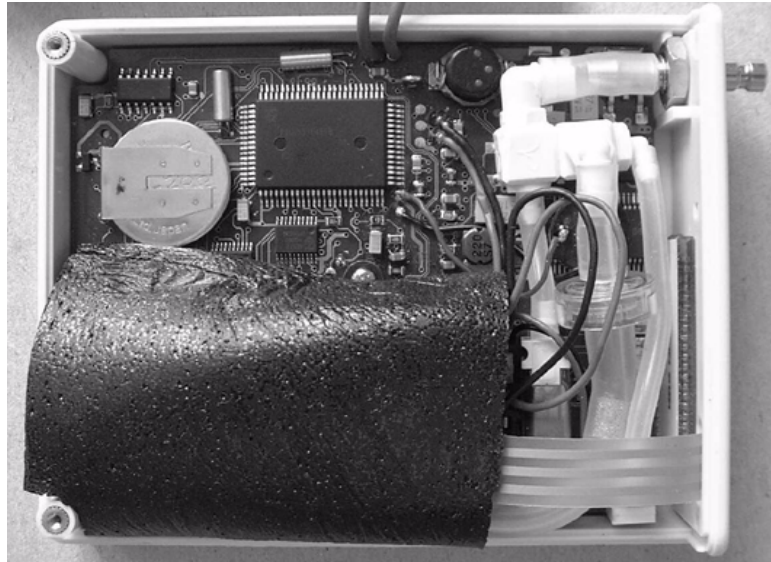
11 : 04	Italian
11 : 05	Spanish
12 : 01	German
12 : 02	English
12 : 03	French
12 : 04	Italian
12 : 05	Spanish
13 : 01	German
13 : 02	English
13 : 03	French
13 : 04	Italian
13 : 05	Spanish
14 : 01	German
14 : 02	English
14 : 03	French
14 : 04	Italian
14 : 05	Spanish
20 : 01	German
20 : 02	English
20 : 03	French
20 : 04	Italian
20 : 05	Spanish

6 Pictures

■ Pictures of TONOPORT V up to version HW1.4



■ Pictures of TONOPORT V for version HW2.0



7 Firmware Loading Procedure for FW1.4

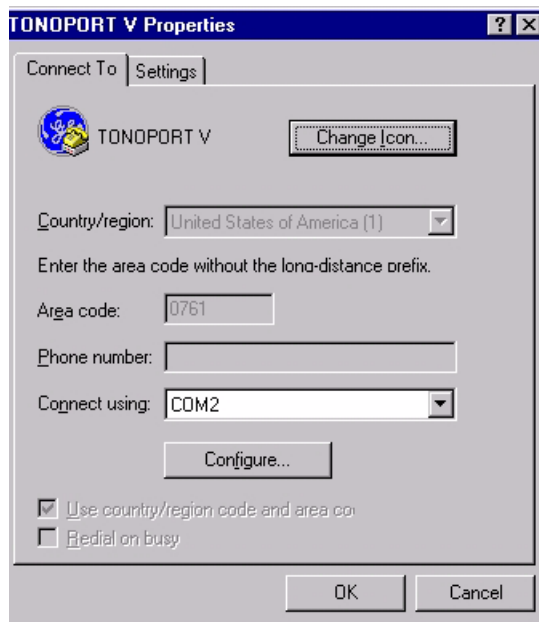
NOTE

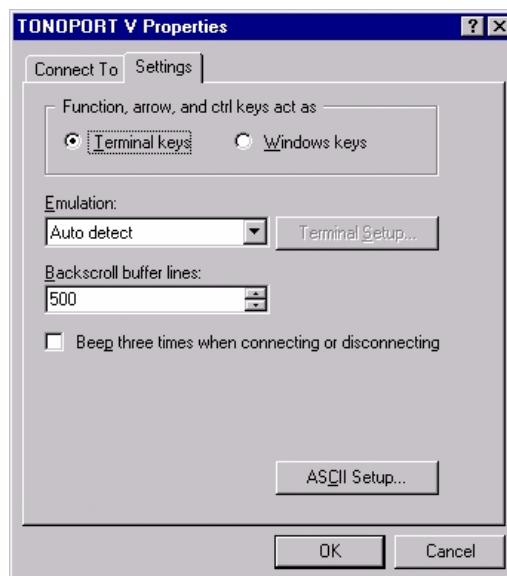
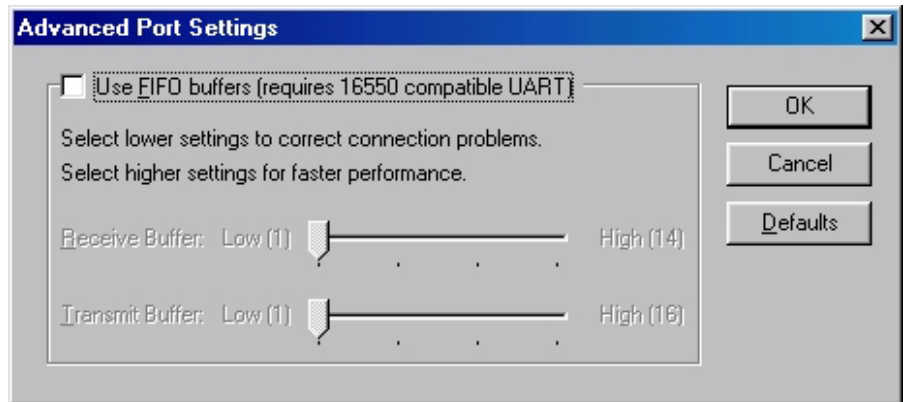
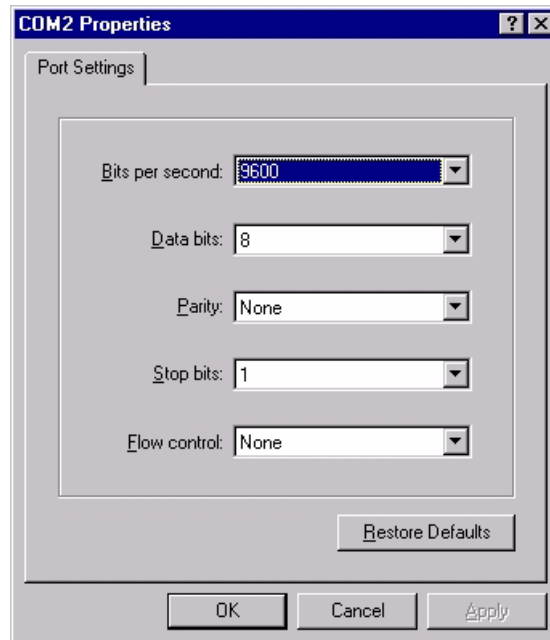
To update older TONOPORT V units (HW1.2 and before), use firmware version FW1.4.

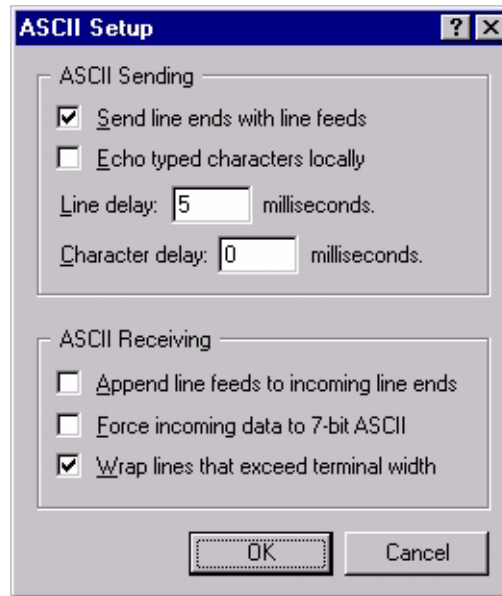
7.1 Preparation

7.1.1 Settings for Hyperterminal under Windows 95/98SE/NT4.0/2000 (in this example with Windows 95SE)

- Start Hypertrm.exe.
- Type in the name: TONOPORT V.
- Type in any Phone Number and click <OK>.
- Go to FILE -> PROPERTIES and make the same configurations as shown in the pictures.
- Go to "Transfer" -> "Send Text File..." to transfer files to TONOPORT.







7.1.2 Settings for Telix for Windows (Hyperterminal for NT does not work)

- Extract all TONOPORT V, FW1.4 Firmware files into one directory (e.g. C:\tonoport\V1.4) by starting: FIRMWARE TONOPORT V FW14.exe
- Load all files from the Telix program into the same directory on the Hard Disk
- Start the Telix program (\telix.exe)

NOTE

- ◆ Enter <ALT> + <p> to select the COM port.
- ◆ Enter <ALT> + <o> to select Ascii transfers. Select F - Line pacing 2.
- ◆ Enter <ALT> + <s> and select ASCII to transfer files to TONOPORT.
- ◆ Delete screen with <ALT> + <c>.
- ◆ Telix can be terminated with <ALT> + <x>.

7.2 Loading Procedure

- Connect inactive TONOPORT to PC COM port via serial cable.
- Start Hyperterminal or Telix on the PC.

NOTE

After TONOPORT V has been switched on, updating can only be carried out within the first 10 minutes. After 10 minutes TONOPORT V enters a power down mode and can be reactivated by switching on and off.

- Follow steps 1...6.

Step	Action		Duration (approx.)	Display	
	TONOPORT V	PC	Telir Hyperterminal	PC monitor	TONOPORT V LCD
1	Switch on TONOPORT V		8 seconds 8 seconds	TONOPORT V - V1.0*, TONOPORT V - V1.1 or TONOPORT V - V 1.2 or TONOPORT V - V 1.3 / "LANGUAGE" TONOPORT V - V 1.4 / "LANGUAGE"	HH:MM (time)
2 ¹		Transfer ERASE.INT	2 seconds 2 seconds		LLLL (flashing)
3 ¹	Press "START"		3 seconds 3 seconds	WAIT-BOOT. ²	0000
4		Transfer BOOT14.PRG	50 seconds 25 seconds	BOOT-WRITE = OK ERASE HAUPT UND DRUCK-PRG	LLLL (flashing)
5	Press "INFO"		11 seconds 11 seconds	ERASE-OK WAIT-HAUPT.PRG VERSION 1.4	all segments ON
6		Transfer HAUPT14.PRG	10 minutes max.	TONOPORT V-FW1.4/DEUTSCH	HHLMM (time)

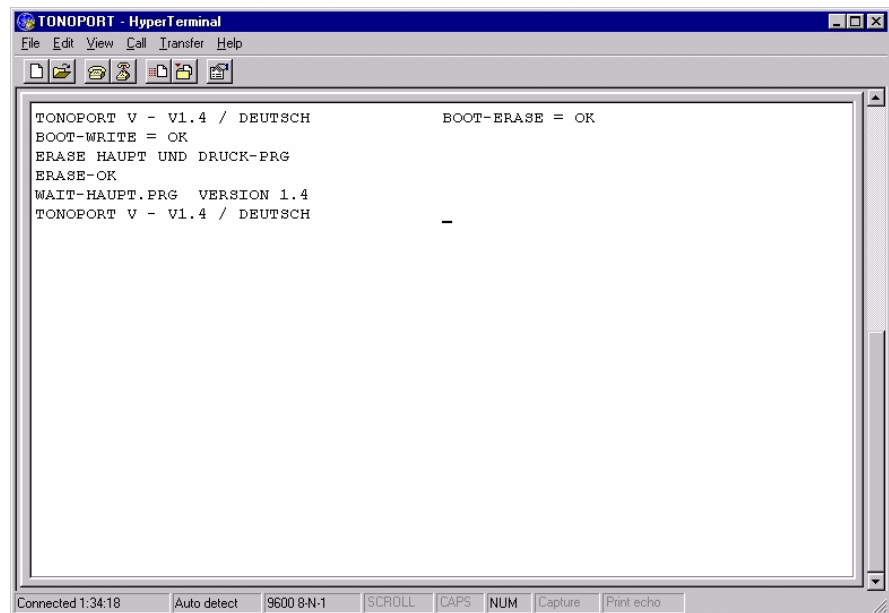
1. Steps 2 and 3 are not applicable if V 1.3 or 1.4 is installed on TONOPORT V.

2. Note down the "LANGUAGE" (DEUTSCH, ENGLISH, FRANCAIS, ITALIANO, ESPAÑOL) which is installed on TONOPORT V (Step1)

- Switch off TONOPORT V.
- Disconnect TONOPORT V from PC.
- Check the correct Firmware version on TONOPORT V and set the correct language:

Step	Action	Display
1	Switch on TONOPORT V	HH:MM (time)
2	Press "INFO" 5 times	H 5
3	Press "START"	14 : 01 (14 = Version FW 1.4 01 = German language)
4	Press "INFO" to select the correct language (which was displayed at Step 1 of the Loading Procedure)	14 : 01 (German) 14 : 02 (English) 14 : 03 (French) 14 : 04 (Italian) 14 : 05 (Spanish)
5	Press "START" to save the language setting	HH : MM (time)

- Screenshot of a successful loading procedure with Hyper Terminal:



For your notes

8 Firmware Loading Procedure for FW2.0

NOTE

To update TONOPORT V HW2.0, use only firmware version 2.0 or higher.

8.1 Settings for TONOPORT V Update Program V2.1 for Windows

- Extract all TONOPORT V, FW2.0 Firmware files into one directory (e.g. C:\Tonoport\V2.0) by starting: TONOPORT_V_Update_FW20.ZIP.
- Start TONOPORT V Update Program by TONOPORT_V_Update_V21.EXE.
- Click the “Setup” button and select the COM port.



8.2 Loading Procedure

- Connect inactive TONOPORT to USB port via USB cable.

NOTE

After TONOPORT V has been switched on, updating can only be carried out within the first 10 minutes. After 10 minutes TONOPORT V enters a power down mode and can be reactivated by switching on and off.

- Click the “Start Update” button and follow the displayed prompts.
- Switch off TONOPORT V.
- Disconnect TONOPORT V from PC.
- Check the correct Firmware version on TONOPORT V and set the correct language:

Step	Action	Display
1	Switch on TONOPORT V	HH:MM (time)
2	Press “INFO” 5 times	H 5
3	Press “START”	20 : 01 (20 = Version FW 2.0 01 = German language)
4	Press “INFO” to select the correct language (which was displayed at Step 1 of the Loading Procedure)	20 : 01 (German) 20 : 02 (English) 20 : 03 (French) 20 : 04 (Italian) 20 : 05 (Spanish)
5	Press “START” to save the language setting	HH : MM (time)

■ Screenshot of a successful loading procedure:



For your notes

9 Diagnosis Codes / Error Codes

Code	Explanation
E 02	Battery depleted. Code is displayed to indicate that the battery charge level is insufficient for further measurements. The recorder differentiates between two states: the memory has just been cleared (i.e., the battery test is performed with a higher power consumption to ensure that a fresh battery will be inserted at the beginning of the measurement) or measurements have already been taken.
E 03	Measurement time over. Code is displayed when a measurement is not taken within 60 seconds (excluding cuff inflation time).
E 06	Inflation time over. The max. inflation time of 60 s has elapsed. This condition indicates a leak in the cuff or tubing, or a defective gasket.
E 07	The pump will not increase the cuff pressure any further. Code is displayed when no systolic reading could be found although the cuff pressure was already increased twice. The measuring system waits until the next measurement is due.
E 08	200 pressure measurements taken; storage capacity exhausted.
E 14	Diastolic reading below 40 mmHg. Code appears when the cuff pressure has dropped to 40 mmHg and diastole could not be identified (TONOPORT does not measure diastolic pressures below 40 mmHg).
E 15	Motion artifact during diastole detection.
E 17	Internal hardware error (inform service center).
E 18	Systolic pressure outside measuring range.
E 19	Diastolic pressure outside measuring range. (These codes are displayed when the systolic and diastolic values are outside the range in which oscillations have been detected. Tighten the cuff slightly.)
E 21	Difference between systolic and diastolic pressure too small (10 mmHg or less)
E 22	Motion artifact during systole detection.
E 24	No systole detected in the provided time frame.
E 26	Systolic pressure below 60 mmHg.

Code	Explanation
E 27	Systolic pressure above 260 mmHg. Max. measuring range exceeded.
E 29	Insufficient number of oscillations detected: For a correct measurement, the system must detect at least 8 oscillations. Tighten the cuff so that one finger, but not two, can be inserted between the patient's arm and the cuff. At the same time the device switches to a deflation rate of 4 mmHg/s. When it detects more than 13 oscillations later on, the rate is changed to 6 mmHg/s.

10 Adjustment Instructions

10.1 Step-by-Step Instructions

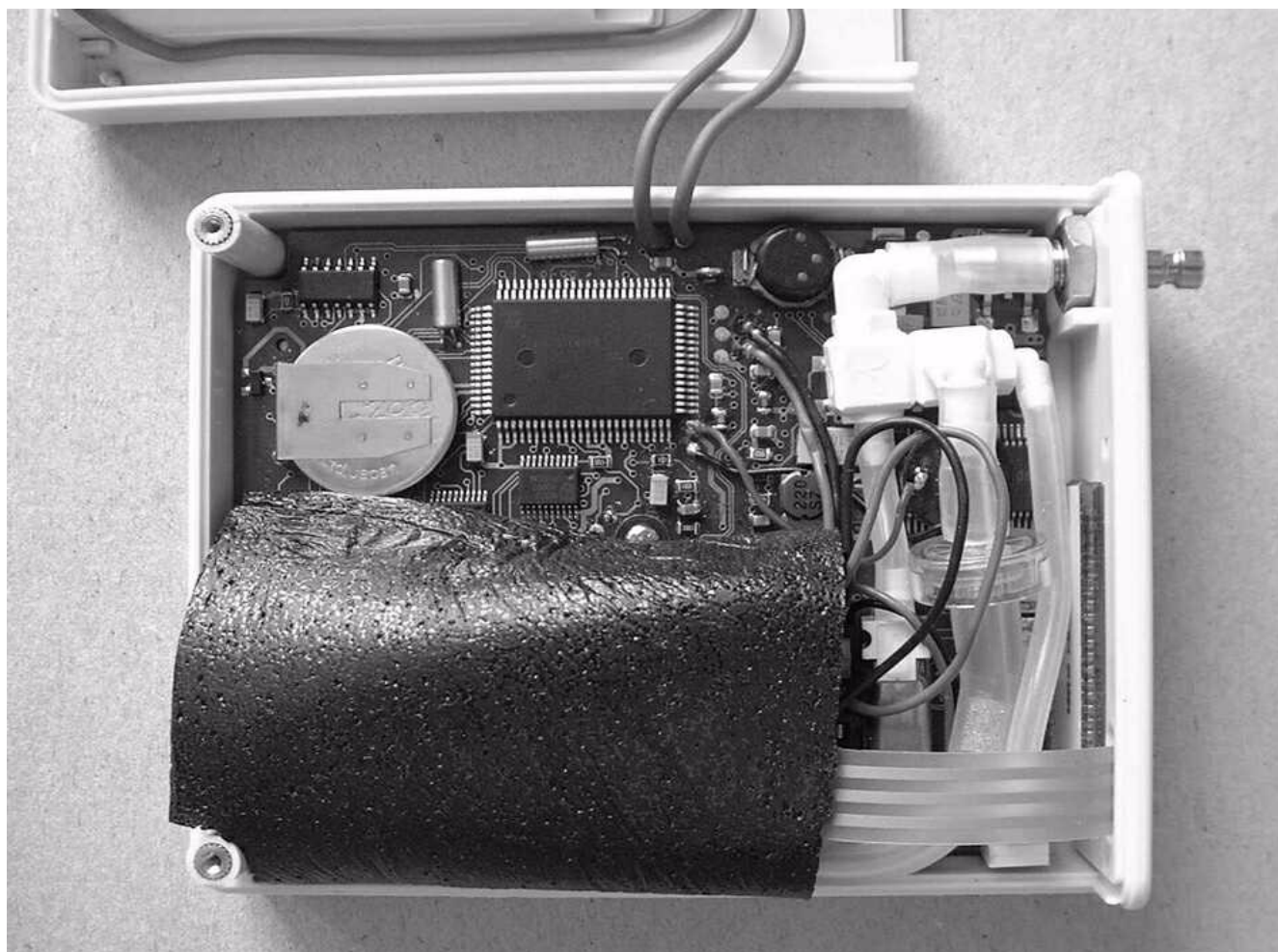
- Only the pressure amplifier needs to be calibrated. This is done by switching on the TONOPORT V and waiting until the time is displayed on the LCD.
- Measure the direct voltages at TP2 and TP3. This is done by turning the trimming potentiometer R59 with a screwdriver until the voltages at TP2 is 1.8 ± 0.1 V and at TP3, 2.0 ± 0.1 V.
- Press "INFO" four times, LCD indicates "H 4".
- Press "START" once, a 2-digit figure is displayed on the LCD.
- Use a screw driver to turn the trimming potentiometer R53 until the LCD indicates a value of approx. 50.
- Connect a reference pressure gauge, a rubber bulb and air container (1 l) to the TONOPORT pressure connector and press "START".
- Using the rubber bulb generate a pressure of 100 mmHg in the tubing system and watch the LCD.
- Using a screwdriver, turn the trimming potentiometer R40 until the LCD indicates a value of 100.
- Also check the values indicated on the LCD at pressures of 50 mmHg, 150 mmHg and 200 mmHg. Max. permitted deviation: ± 3 mm Hg.
- Switch the TONOPORT off.

10.2 Interior View

■ TONOPORT V up to Version HW1.4



■ TONOPORT V, V2.0



For your notes

11 Technical Specifications

■ Microprocessor

P80C558EFB

Storage capacity

128 x 8 bit (= 1 Megabit) EEPROM

512 x 8 bit (= 4 Megabit) EEPROM

■ Measuring range

Systolic pressure: 60 ... 260 mmHg

Diastolic pressure: 40 ... 220 mmHg

Mean pressure: 50 ... 260 mmHg

Pulse rate (HR): 35 ... 240 min⁻¹

■ Recording period

30 h or 200 measurements max.

■ Battery

2 Mignon (size AA) NiMH batteries, 1.2 V, ≥ 1500 mAh (HR-3U SANYO) or

2 Mignon (size AA) NiMH batteries, 1.2 V, ≥ 2100 mAh (HHR-210AA Panasonic) or

2 Mignon (size AA) alkaline batteries

Battery charging time: 2 ... 3 h

■ Max. cuff pressure

300 mmHg

■ Measuring method

oscillometric

■ Ambient conditions

■ Operation

Temperature +10...+ 40 °C

Relative humidity 30...75 %, no condensation

Atmospheric pressure 700 hPa (altitude +2800 m relative to sea level) to 1060 hPa (-400 m relative to sea level)

■ Transport and storage

Temperature -10...+ 70 °C

Relative humidity 10...90 %, no condensation

Atmospheric pressure 500 hPa (altitude +4500 m relative to sea level) to 1060 hPa (-400 m relative to sea level)

■ **Dimensions**

Height 27 mm

Width 80 mm

Depth 100 mm

■ **Weight**

199 g with batteries

12 Technical Inspections

12.1 Technical Safety Inspections

The safety must be verified every year.

These inspections should be referred to independent persons with adequate training and experience.

The Technical Safety Inspections involve checking the overpressure limit and the time measurement mechanism of the device (the time measurement mechanism controls the maximum permitted time for a blood pressure measurement).

- **Checking the overpressure limit:**
 - Connect a rubber bulb and a suitable pressure gauge between pressure hose and a fixed volume of 0,5 liter (e.g. glass bottle), using a T-adapter.
 - Switch off device and switch it on again after a few seconds.
 - Wait until display indicates **the time**.
 - Press **INFO** four times: display indicates "**H 4**".
 - Press **START**: display indicates internal value, which must lie between 30 and 70. If the value lies outside this range, the TONOPORT V must be sent in for inspection.
 - Press **START** again: display indicates "**0**" (the device is now in the calibration mode and the display indicates the pressure in mmHg).
 - Increase with the rubber bulb a pressure a little over 300 mmHg. When a pressure over 300 mmHg is reached, the internal valve of the device will open and the pressure decreases quickly to 0 mmHg. The device has left the calibration mode and the display indicates the time again. If the pressure does not decrease, the TONOPORT V must be sent in for inspection.
- **Checking the time measurement mechanism of the device, which controls the maximum permitted time for a blood pressure measurement:**
 - Switch off device and switch it on again after a few seconds.
 - Wait until display indicates **the time**.
 - Let the pressure connector of the device open.
 - Press **START**, after a short time the pump starts running.
 - Measure the time between start running the pump and stopping the pump.
 - The time must be 130 sec max. for the TONOPORT V, V2.0 and 100 sec max. for the TONOPORT V, HW 1.2, FW1.4. If the time is over these values, the TONOPORT V must be sent in for inspection.

12.2 Technical Inspections of the Measuring System

The non-invasive pressure measurement system must be verified every 2 years.

These inspections should be referred to independent persons with adequate training and experience.

"Technical Inspections of the Measuring System" involve checking the pneumatic system for leaks and the accuracy of the values indicated on the display.

This will be achieved in the calibration mode:

- Connect a rubber bulb and a suitable pressure gauge between pressure hose and a fixed volume of 0,5 liter (e.g. glass bottle), using a T-adapter.
- Switch off device and switch it on again after a few seconds.
- Wait until display indicates **the time**.
- Press **INFO** four times: display indicates "**H 4**".
- Press **START**: display indicates internal value, which must lie between 30 and 70. If the value lies outside this range, the TONOPORT V must be sent in for inspection.
- Press **START** again: display indicates "**0**" (the device is now in the calibration mode and the display indicates the pressure in mmHg).
- Generate a test pressure of 200 mmHg and, after waiting for at least 30 seconds, measure the pressure decrease (pressure decreases ≈ 3 mmHg/min. are typical, when the pressure decrease exceeds 3 mmHg/min., there must be a leak and the system needs to be repaired).

This completes the test on the system for leaks.

- Using the rubber bulb, exert pressures of 50, 100, 150, 200 and 250 mmHg on the device. Deviations must not exceed ± 3 mmHg.
- Press **START** to exit the calibration mode.

13 Parts Lists

13.1 Manuals

Part No.	Description
2001589-023	Service Manual (English only)
2001589-034	Multilanguage Operator's Manual TONOPORT V, V1.4
2001589-039	Operator's Manual TONOPORT V, V2.0 GER/ENG/FRE/ITA/SPA/POR
2001589-043	Operator's Manual TONOPORT V, V2.0 DUT/SWE/DAN/NOR/JPN
2001589-044	Operator's Manual TONOPORT V, V2.0 RUS/POL/CZE/HUN/SLO/CHS

13.2 Accessories

Part No.	Description
2001589-011	Cable RS232 TONOPORT V ———> PC (with CardioSoft V4.14 or higher)
2001589-012	Cable RS232 TONOPORT V ———> Printer (LQ-Emulation)
2001589-040	Cable USB TONOPORT V ———> PC (approx. 1.5 m)
2001589-015	Carrying Bag
2001589-016	Bag Belt
2001589-013	Battery Charger NiMH + NiCd
2001589-041	Battery Charger NiMH/2
2001589-014	Rechargeable Battery NiMH Size AA
73700008	Alkaline Battery 1,5 V Mignon Size AA
2001589-017	BP Cuff Adult Small 17-26 cm
2001589-018	BP Cuff Adult Standard 24-32 cm
2001589-019	BP Cuff Adult Large 32-42 cm

13.3 Spare Parts

Part No.	Description
2002857-001	Cover Battery
2002858-001	Cover Bottom with Switch and Cable
2002859-001	Cover Top with Keypad V1
2002859-002	Cover Top with Keypad V2.0
2002860-001	Battery Button Cell Lithium CR2016 PCB 3V, 90mAh
2002861-001	Keypad
2002862-001	Battery Contact
2002863-001	Switch On / Off
2002864-001	Hose Connector (Luer)
2002865-002	Pump (low noise)
2002866-003	PCB HW1.2 for low noise pump
2006591-001	Label for Calibration: "Nächste MTK" (only for Germany)
2002866-004	PCB HW2.0 (with Motorola Pressure Sensor and LCD)
2032506-001	Speaker TONOPORT V, V2.0

■ Using the right spare parts for the corresponding instrument version

(only for versions up to HW1.2)

In the following list, you see the serial numbers of older Tonoport V. Instruments beginning with these serial numbers also have the low noise pump and the PCB HW1.2. That means if you have a TONOPORT V with lower serial numbers than in the list, then upgrade to devices with the low noise pump and with the PCB HW1.2. If you use the low noise pump, it is always necessary to use the corresponding PCB HW1.2.

Device	Part No.	Serial No.
TONOPORT V (GER)	2001589-001	101127985
TONOPORT V (ENG)	2001589-002	101124229
TONOPORT V (FRE)	2001589-003	101131780
TONOPORT V (ITA)	2001589-004	101128014
TONOPORT V (SPA)	2001589-005	101124230

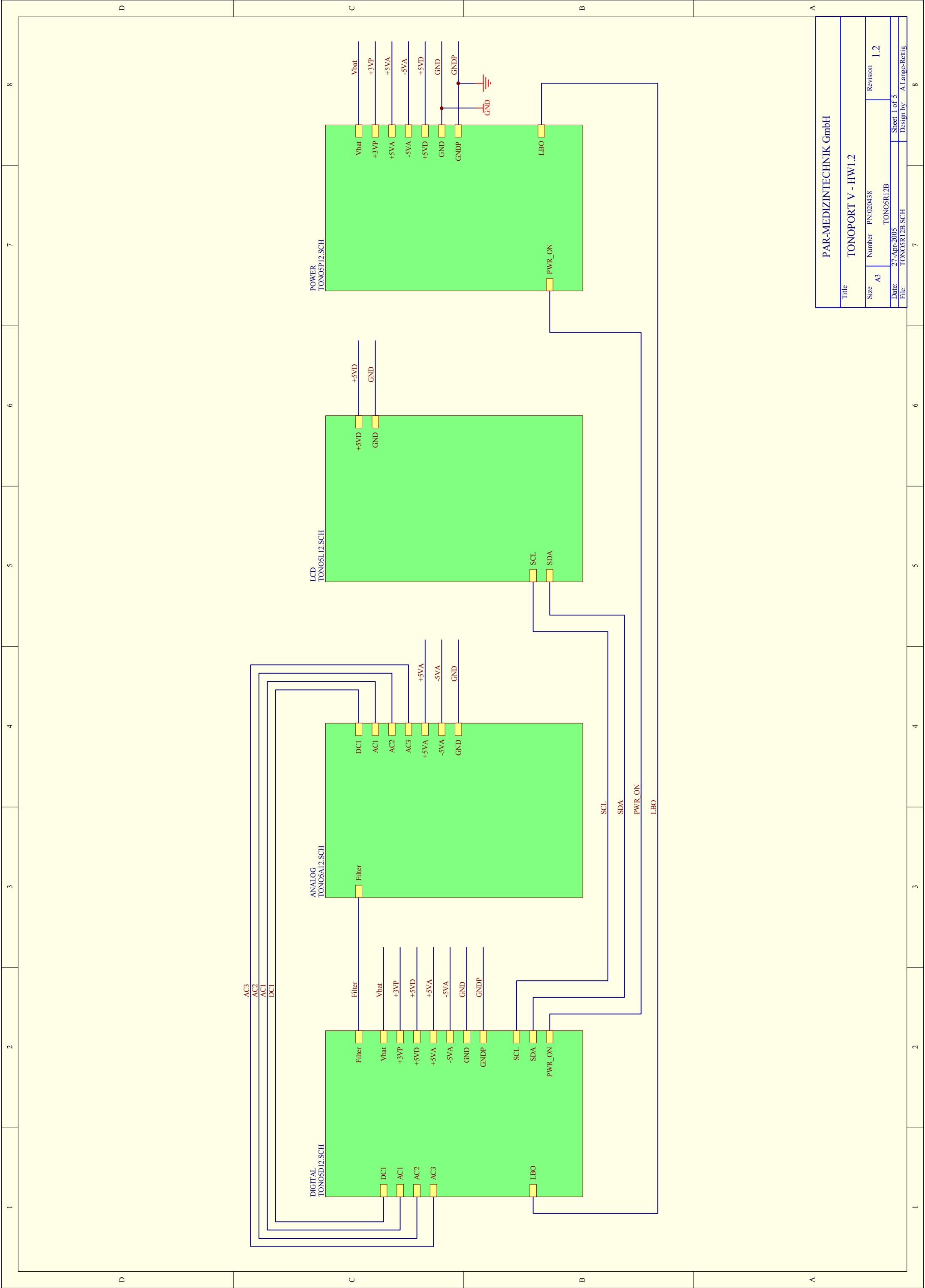
13.4 Exchange Units

Part No.	Description
2003386-001	Exchange Recorder ABP TONOPORT V German
2003386-002	Exchange Recorder ABP TONOPORT V, V2.0

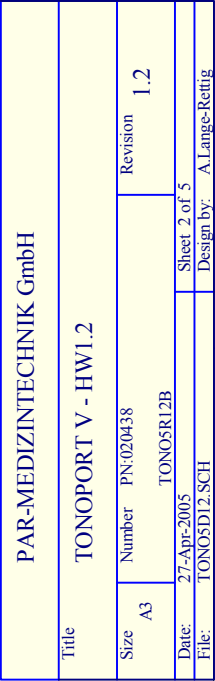
For your notes

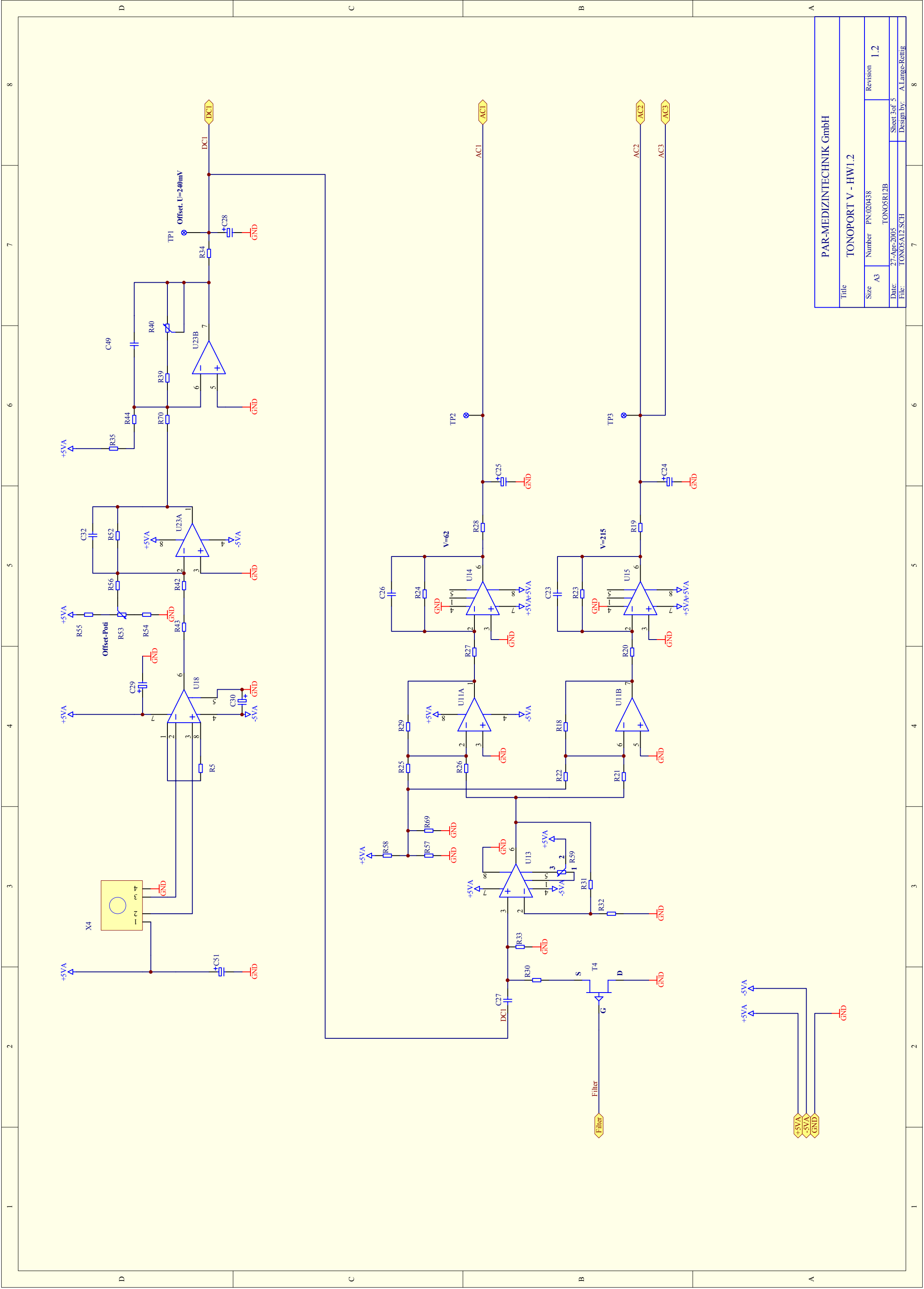
14 Appendix: Drawings

For your notes

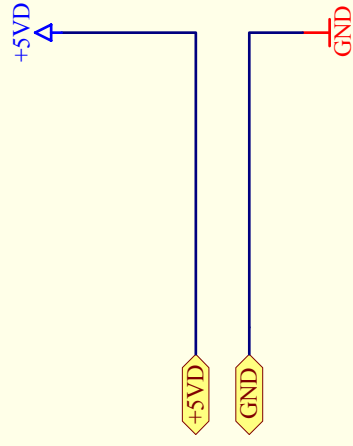
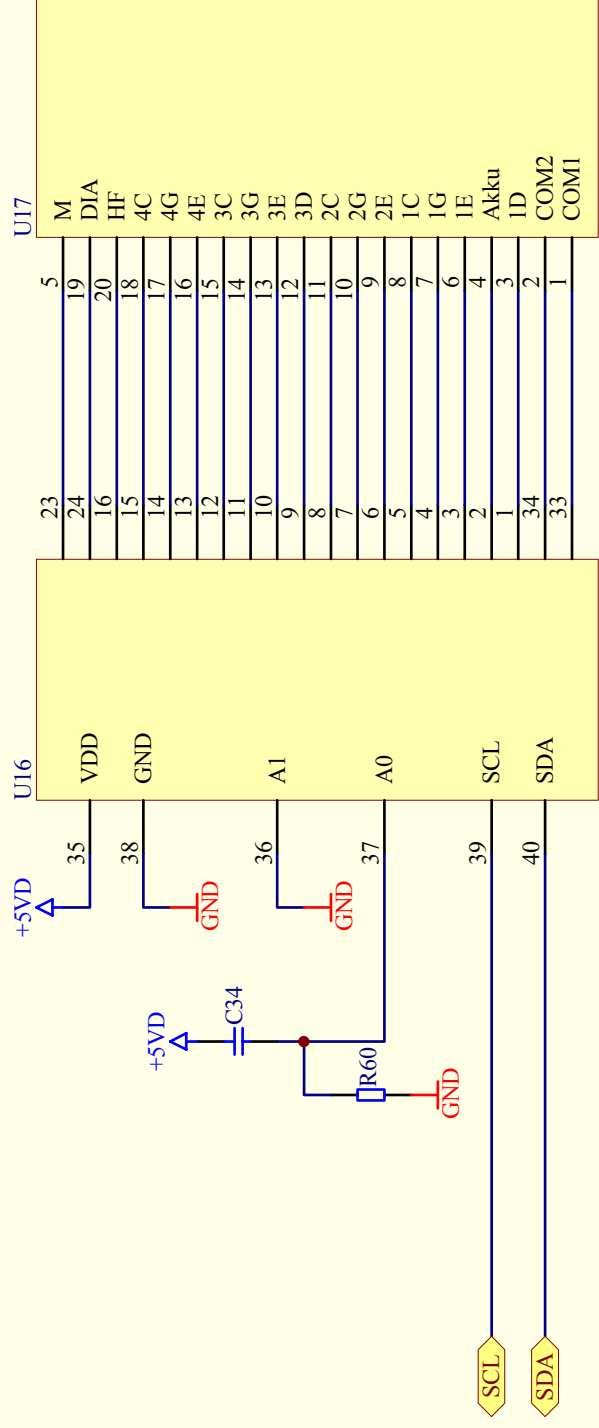


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File: TONO5R12B.SCH	Design by: A Lange-Rettig		

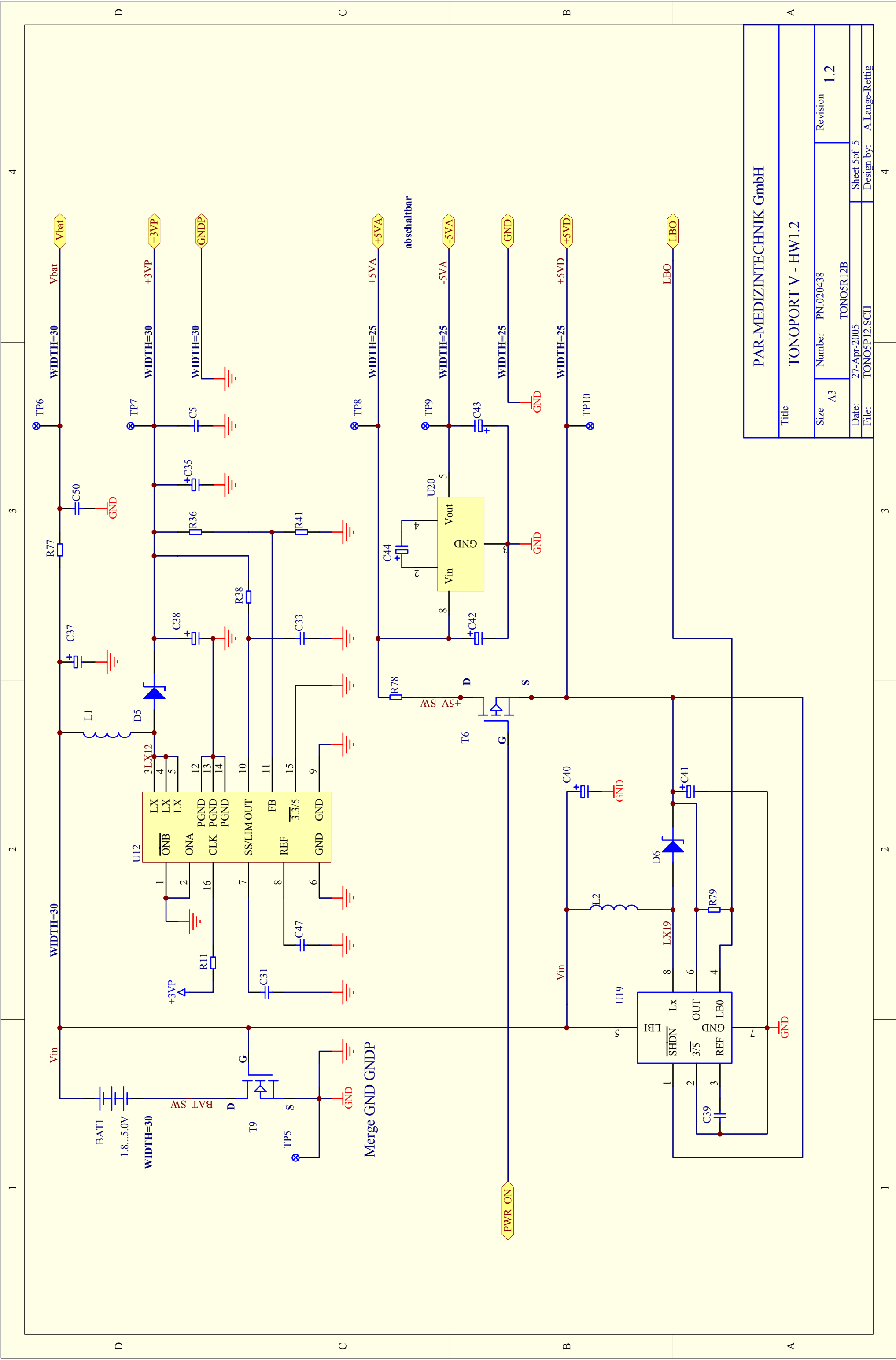


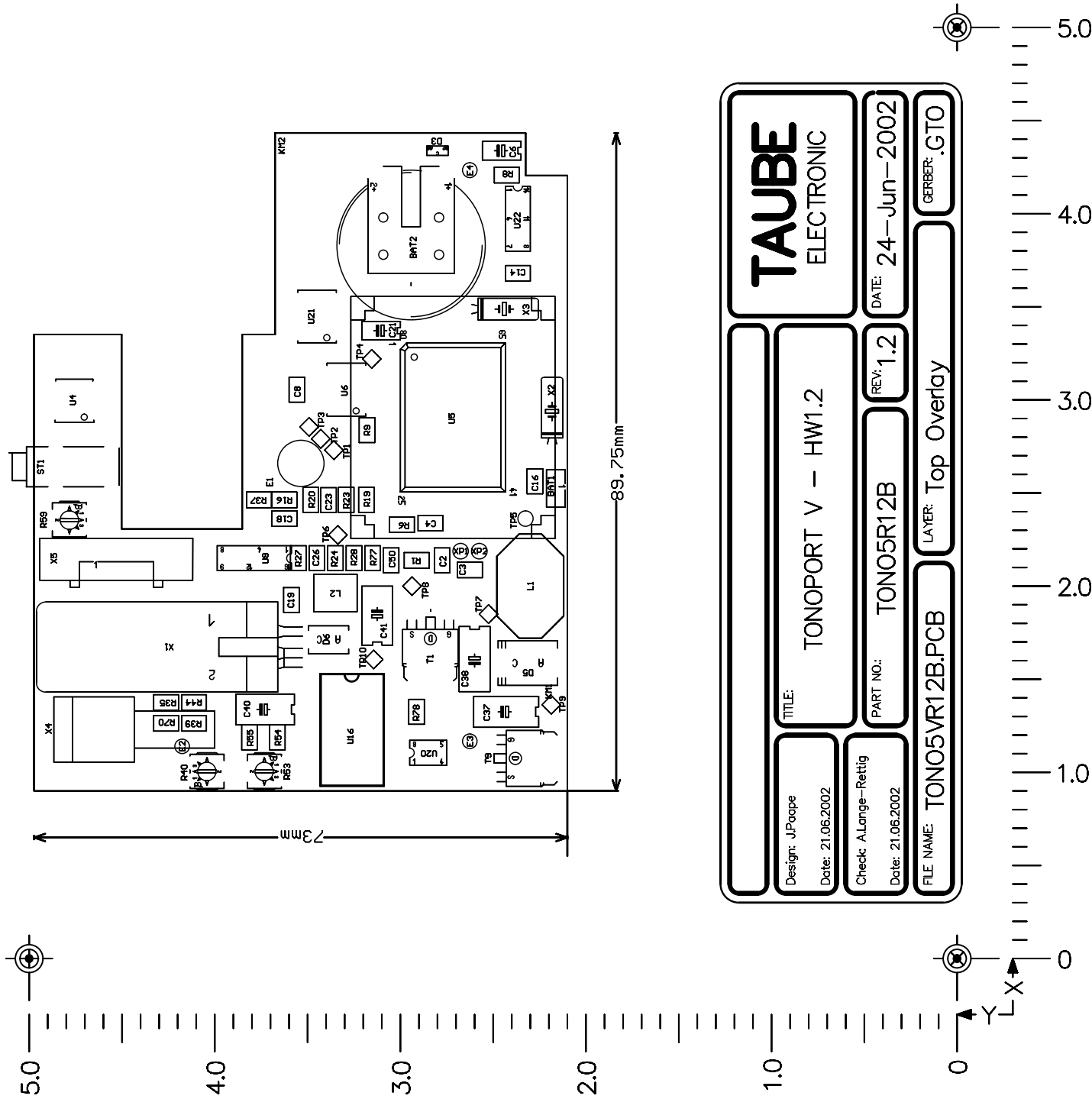


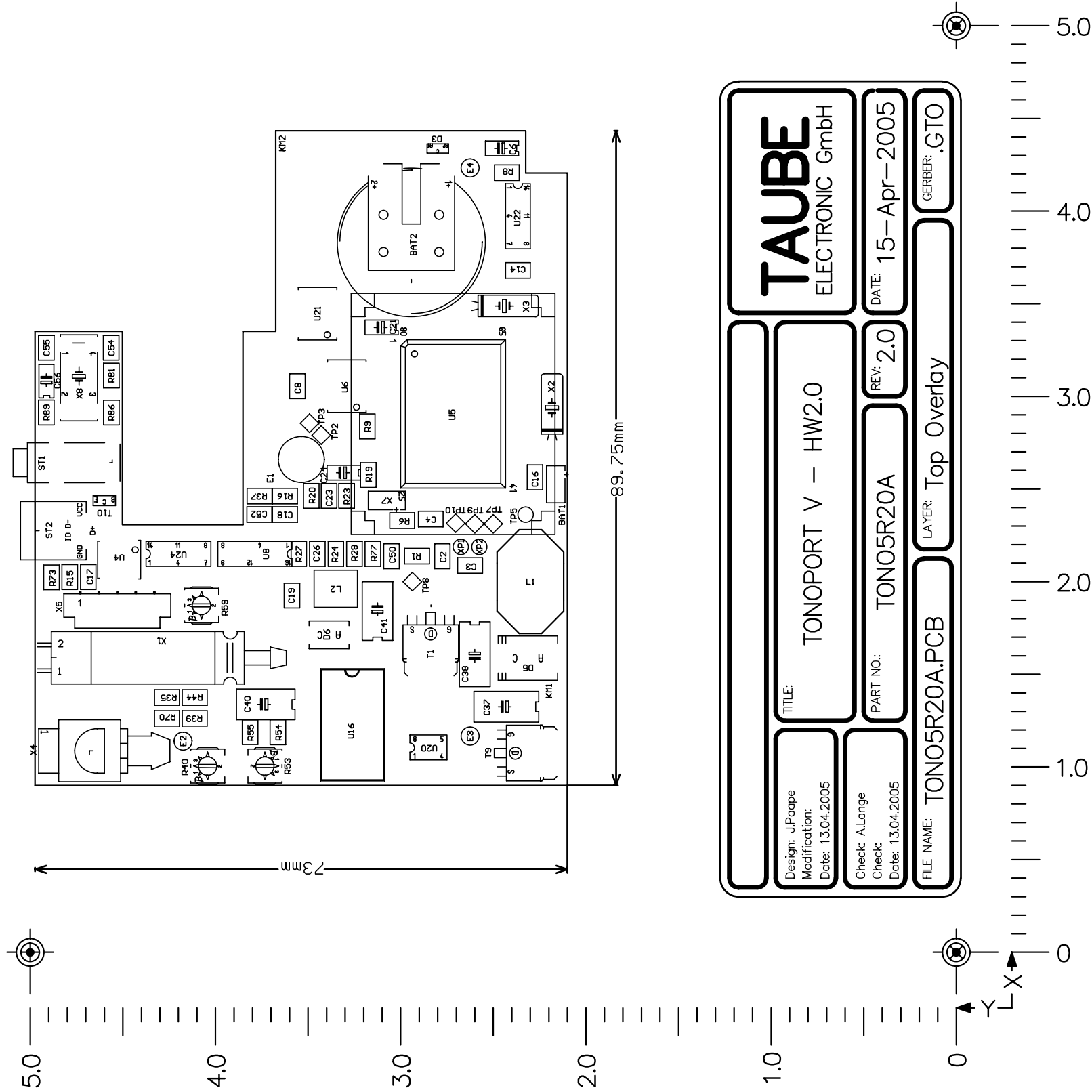
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Date:	27-Apr-2005		Sheet 4of 5
File:	TONO5L12.SCH		Design by: A.Lange-Rettig









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